

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 10/693,584 Confirmation No.: 1077
Applicant(s) : Baiyi ZHAO et al.
Filed : October 24, 2003
TC/A.U. : 1793
Title : *Late Transition Metal Catalysts for Olefin Oligomerizations*
Examiner : James E. McDONOUGH
Docket No. : 2002B130/2
Customer No. : 23455
Date : April 19, 2010

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Response to Notice of Non-Compliant Appeal Brief Under 37 C.F.R. § 41.37

This response is filed within one month of a notice of non-compliant Appeal brief dated March 19, 2010. The Notice stated that the brief did not contain a correct copy of the appealed claims. Applicant respectfully disagrees and submits that section VII on pages 13-33 contained the correct clean copy of the appealed claims. Applicant notes that as a courtesy Applicant included a copy of an unentered amendment as Appendix XI at page 61-82. Perhaps the Office mistakenly thought Appendix XI was the appealed claim set rather than a courtesy copy of an unentered amendment? Applicant's Attorney placed phone calls on April 2 and April 19 to the Office to clarify the issue, however the Attorney's calls were not returned.

In any event, in an abundance of caution, Applicant herewith submits a new Appendix VII listing the appealed claims. Applicant respectfully requests that the attached clean copy of the appealed claims be accepted and inserted into the Appeal Brief at page 13.

Please charge any deficiency in fees or credit any overpayments during the entire pendency of this case to Deposit Account No. 05-1712. Please also charge any petition fees, including fees for extensions of time necessary for the pendency of this case or copendency of this application with another application at any time to Deposit Account No. 05-1712.

Respectfully submitted,

April 19, 2010

Date

/Catherine L. Bell/

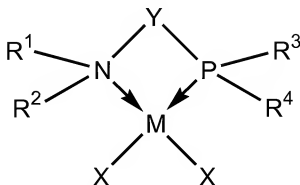
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VIII. APPENDIX: Listing of Claims:

1. (Cancelled)
2. (Previously Presented) A composition of matter with the following formula:



wherein

M is iron, cobalt, or nickel;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are hydrocarbyl radicals;

Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals; and

(f) each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate; or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

3. (Previously Presented) The composition of matter of Claim 2 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{40} hydrocarbyls.

4. (Previously Presented) The composition of matter of Claim 3 wherein R^1 , R^2 , R^3 , and R^4 are C_1 - C_{30} hydrocarbyls.

5. (Previously Presented) The composition of matter of Claim 4 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

6. (Previously Presented) The composition of matter of Claim 5 wherein R^1 , R^2 , R^3 , and R^4 are methyl, ethyl, propyl, butyl, cyclohexyl, phenyl, tolyl, benzyl, or phenethyl.

7. (Cancelled)

8. (Cancelled)

9. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are dimethylamino, diethylamino, methylethylamino, phenoxy, or benzoxy.

10. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, or tolyl.

11. (Previously Presented) The composition of matter of Claim 2 wherein both X ligands are independently allyl, or 1,1-dimethyl allyl.

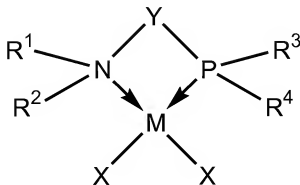
12. (Cancelled)

13. (Previously Presented) The composition of matter of Claim 12 wherein M is nickel.

14. (Previously Presented) The composition of matter of Claim 12 wherein both X groups are a chloride, bromide or iodide.

15. (Previously Presented) The composition of matter of Claim 2 wherein Y is biphenyl.

16. (Previously Presented) A composition of matter with the following formula:



wherein

M is nickel, cobalt or iron,

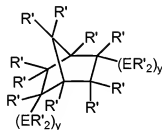
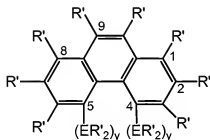
N is nitrogen;

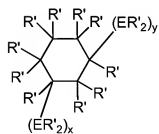
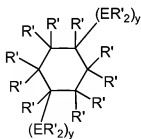
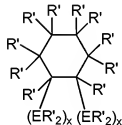
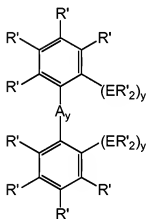
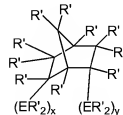
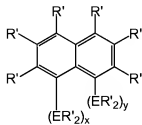
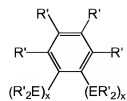
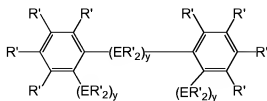
P is phosphorus;

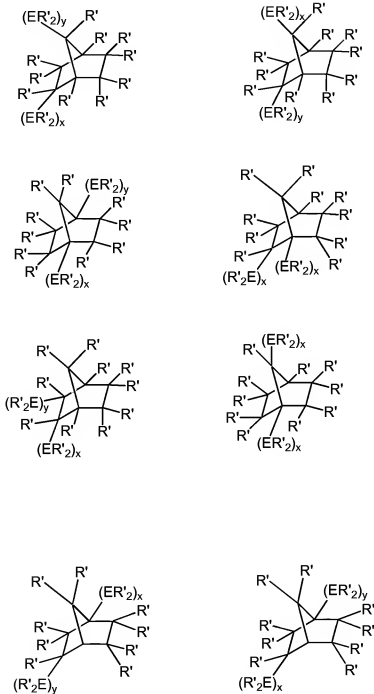
R^1 , R^2 , R^3 , and R^4 are hydrocarbaryl radicals;

each X is independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, methoxy, ethoxy, propoxy, butoxy, dimethylamino, diethylamino, methylethylamino, phenoxy, benzoxy, allyl, 1,1-dimethyl allyl, 2-carboxymethyl allyl, 1,1,1,5,5,5-hexa-fluoroacetylacetonate, 1,1,1-trifluoro-acetylacetonate, and 1,1,1-trifluoro-5,5-di-methylacetylacetonate, or the two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene;

Y has one of the following formulas:







where

R' are hydrogen or C_1 - C_{50} hydrocarbyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;
x is an integer from 1 to 4; and
y is an integer from 0 to 4.

17. (Previously Presented) The composition of Claim 16 wherein A is C=O, C=S, O, S, SO₂, NR*, PR*, BR*, SiR*₂, or GeR*₂ wherein each R* is a hydrocarbyl or halocarbyl radical.

18. (Withdrawn) A composition of matter comprising the reaction product of an activator and the composition of matter of Claim 2.

19. (Withdrawn) A composition of matter comprising the reaction product of

- (a) the composition of matter of Claim 18 and
- (b) ethylene, propylene, 1-butene, or a mixture of any two or all three of ethylene, propylene, and 1-butene.

20. (Withdrawn) A polymerization method comprising the step of providing at least one composition of matter of Claim 2.

21. (Withdrawn) The polymerization method of Claim 20 wherein the activity of the composition of matter exceeds 8000 moles of ethylene per mole transition metal per hour.

22. (Withdrawn) The polymerization method of Claim 20 further comprising recovering a product comprising greater than 50 wt% of linear C₄-C₁₄ α -olefins based on the total weight of polymerized product.

23. (Withdrawn) The polymerization method of Claim 22 wherein the product comprises greater than 80 wt% of linear C₄-C₁₄ α -olefins.

24. (Withdrawn) The polymerization method of Claim 23 wherein the product comprises greater than 50 wt% of linear C₄ and C₆ α -olefins.

25. (Withdrawn) The polymerization method of Claim 24 wherein the product comprises greater than 80 mol% of linear C₄ and C₆ α -olefins.

26. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the formula of the composition of matter of claim 2,
wherein:

M is iron, nickel, or cobalt; and
 R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals.

27. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the formula of the composition of matter of claim 2
wherein:

M is nickel, iron, or cobalt;
(ii) R^1 , R^2 , R^3 , and R^4 are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals; and

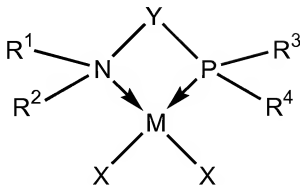
(iii) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, or 1,4-butylene.

28. (Withdrawn) The composition of matter of claim 27 wherein

- (i) R^1 , R^2 , R^3 , and R^4 are independently selected from methyl, ethyl, and propyl; and
- (ii) Y is selected from butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radicals.

29. (Withdrawn) A composition of matter comprising the reaction product of:

- (a) an activator; and
- (b) a catalyst precursor with the following formula:



wherein

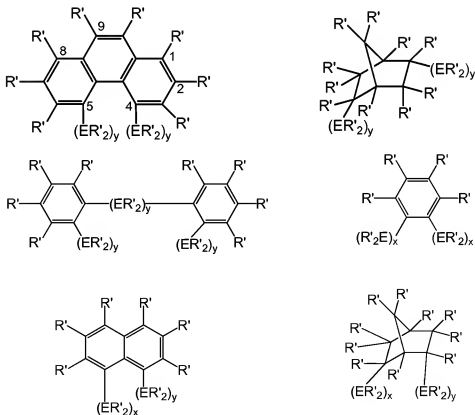
M is a Group-8, -9, or -10 transition metal, excluding palladium,

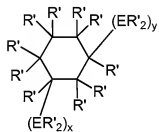
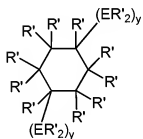
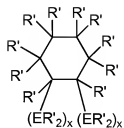
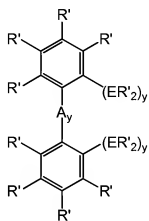
N is nitrogen;

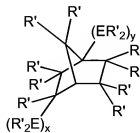
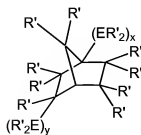
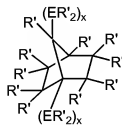
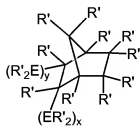
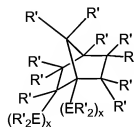
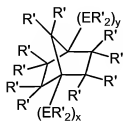
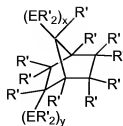
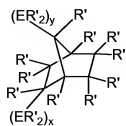
P is phosphorus;

R^1 , R^2 , R^3 , and R^4 are hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C₁-C₅₀ hydrocarbaryl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

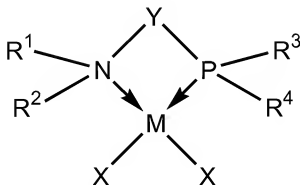
y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, diethylamino, methylethylaminodimethylamin; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

30. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is iron, nickel, or cobalt,

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl,

pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

Y is a hydrocarbyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

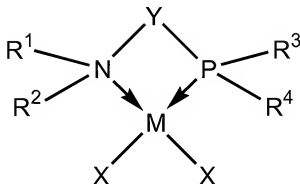
(vi) X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino; or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-

2,3-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

31. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

M is nickel, iron, cobalt, platinum, ruthenium, rhodium, or iridium;

N is nitrogen;

P is phosphorus;

R¹, R², R³, and R⁴ are independently methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, ethenyl, propenyl, butenyl, pentenyl, hexenyl, heptenyl, octenyl, nonenyl, decenyl, undecenyl, dodecenyl, ethynyl, propynyl, butynyl, pentynyl, hexynyl, heptynyl, octynyl, nonynyl, decynyl, undecynyl, dodecynyl, phenyl, benzyl, phenethyl, tolyl, cyclobutyl, cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl, cyclononyl, cyclodecyl, or cyclododecyl radicals;

Y is a hydrocarbonyl bridge comprising a backbone wherein the backbone comprises a chain that is four or more carbon atoms long and is selected from

the group consisting of butylene, pentylene, hexylene, heptylene, octylene, nonylene, decylene, undecylene, dodecylene, tridecylene, tetradecylene, pentadecylene, hexadecylene, heptadecylene, octadecylene, nonadecylene, eicosylene, heneicosylene, docosylene, tricosylene, tetracosylene, pentacosylene, hexacosylene, heptacosylene, octacosylene, nonacosylene, triacontylene, cyclohexylene, cyclooctylene, cyclodecylene, cyclododecylene, biphenyl, butenylene, penentylene, hexenylene, heptenylene, octenylene, nonenylene, decenylene, undecenylene, dodecenylene, hexynylene, heptynylene, octynylene, nonynylene, decynylene, undecynylene, dodecynylene, butadienylene, pentadienylene, hexadienylene, heptadienylene, octadienylene, nonadienylene, decadienylene, undecadienylene, dodecadienylene, hexatrienylene, octatrienylene, decatrienylene, and dodecatrienylene radical; and

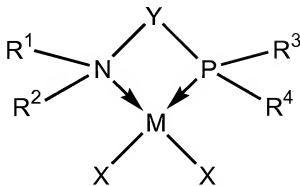
X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, methylethylamino or two X's are connected to form catecholate, 3,5-dibutylcatecholate, 3,6-dibutylcatecholate, 3,6-dibutyl-4,5-dimethoxycatecholate, 3,6-dibutyl-4,5-dichlorocatecholate, 3,6-dibutyl-4,5-dibromocatecholate, 1,3-propylene, chloride, bromide, iodide, or 1,4-butylene.

32. (Withdrawn) The polymerization method of claim 31 wherein Y is a biphenyl radical.

33. (Withdrawn) A polymerization method wherein the catalysts activity exceeds 8000 moles of ethylene per mole transition metal per hour comprising the step of providing at least one composition of matter comprising the reaction product of:

an activator; and

a catalyst precursor with the following formula:



wherein

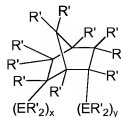
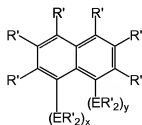
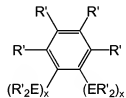
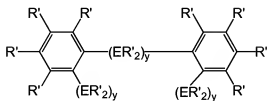
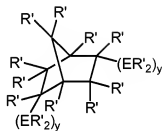
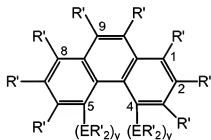
M is a Group-8, -9, or -10 transition metal,

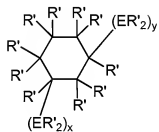
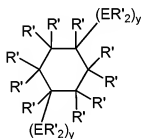
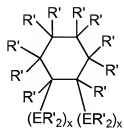
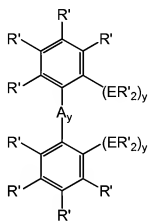
N is nitrogen;

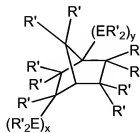
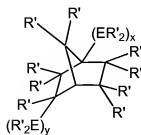
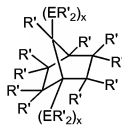
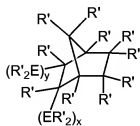
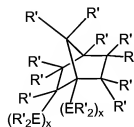
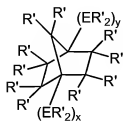
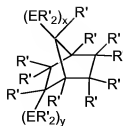
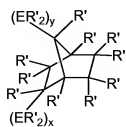
P is phosphorus;

R¹, R², R³, and R⁴ are independently hydrocarbyl radicals;

Y is represented by one of the following formulas:







where

R' are independently, hydrogen or C_1 - C_{50} hydrocarbonyl radicals;

A is a non-hydrocarbon atom functional group;

E is a Group-14 element;

x is an integer from 1 to 4;

y is an integer from 0 to 4; and

X are independently dimethylamide, diethylethoxide, phenoxide, methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl, heneicosyl, docosyl, tricosyl, tetracosyl, pentacosyl, hexacosyl, heptacosyl, octacosyl, nonacosyl, triacontyl, hydride, phenyl, benzyl, phenethyl, tolyl, dimethylamino, diethylamino, chloride, bromide, iodide, or methylethylamino.